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IV. *Extracts of several Letters to the Publisher, from the Reverend Dr. Langwith, Rector of Petworth in Suffex, concerning the Appearance of several Arches of Colours contiguous to the inner Edge of the common Rainbow.*

WHEN the Primary Rainbow has been very vivid, I have observ'd in it, more than once, a second Series of Colours within, contiguous to the first, but far weaker, and sometimes a faint Appearance even of a third. These increase the Rainbow to a Breadth much exceeding what has hitherto been determin'd by Calculation. I remember, I had once an Opportunity of making an ingenious Friend take notice of this Appearance, who was much surpriz'd at it, as thinking it not to be reconciled with the Theory.

*Petworth, Jan. 12.*

172<sup>1</sup>/<sub>2</sub>.

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SINCE my last I have observ'd something of the same Nature, though not in the same Degree of Perfection, with what I sent you an Account of before. On *Saturday* last, a little before six in the Evening, Wind at N.W. by W. we had here a lively, distinct, primary Rainbow, the inner and purple Colour of which had a far greater Mixture of red in it, than I could ever observe

serve in Sir *Isaac Newton's* oblong *Spectrum*. Under this was a space, of a Breadth considerably less than that of the *Limbus* of the Rainbow, in which I could not distinguish any Colours: Still lower was a faint interrupted Arch of red, inclining to purple, which appear'd and vanish'd several times, while I was intent upon observing it.

My Suspicion about this Phænomenon is, that the extraordinary Redness in the purple of the first Rainbow, is owing to the Mixture of the red Rays of a second Series of Colours, with the purple Rays of the first; that the colourless Space consisted of Rays which are too weak to affect the Sight with distinct Colours; and that the innermost broken Arch was the ending of a second and beginning of a third *Iris*.

*P. S.* I forgot to tell you, that as in the Account I send you here, I saw the purple of the second *Iris* without the other Colours, so I have seen the other Colours, but not very distinct, without the purple: as also, that I could never see more than one Series of Colours near the Horizon.

*Petworth, March 22.*

172 $\frac{1}{2}$ .

**Y**esterday in the Evening, about a quarter before Six, Wind S. W. we had one of the finest Rain- that ever I beheld.

The first Series of Colours was as usual, only the Purple had a far greater Mixture of red in it, than I have ever seen in the prismatick Purple: Under this was a colour'd Arch, in which the green was so predominant,

dominant, that I could not distinguish either the yellow or the blue : Still lower was an Arch of purple, like the former, highly saturate with red, under which I cou'd not distinguish any more Colours.

I had the Pleasure of viewing this delightful Object for a considerable time, without that vanishing and returning of Colours which I describ'd in my last.

The Order of the Colours in this compounded Rainbow was, you see, red, yellow, green, blue, a Mixture of purple and red, green, (or rather a Mixture of yellow, green, and blue) a Mixture of purple and red.

I begin now to imagine, that the Rainbow seldom appears very lively without something of this Nature, and that the suppos'd exact Agreement between the Colours of the Rainbow and those of the Prism, is the reason that it has been so little observ'd.

*Petworth, March 27.*

1722.

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**I** Am afraid I shall tire you with the History of this Phænomenon; but I have seen it in such Perfection since the writing my last, that I cannot help being particular in my Account of it.

*August* the 21<sup>st</sup>, about half an hour past 5 in the Evening, Weather temperate, Wind at N.E. the Appearance was as follows; *viz.*

The Colours of the Primary Rainbow were as usual, only the purple very much inclining to red, and well defin'd : Under this was an Arch of green, the upper part of which inclin'd to a bright yellow, the lower to a more dusky green : Under this were alternately two Arches of reddish purple and two of green : Under all a faint Appearance of another Arch of purple, which vanish'd  
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and return'd several times so quick, that we cou'd not steadily fix our Eyes upon it. Thus the Order of the Colours was

I. Red, Orange Colour, Yellow, Green, Light Blue, Deep Blue, Purple.

II. Light Green, Dark Green, Purple.

III. Green, Purple.

IV. Green, faint vanishing Purple.

You see we had here four Orders of Colours, and perhaps the beginning of a fifth, for I make no question but that what I call the Purple, is a Mixture of the Purple of each of the upper Series with the Red of the next below it, and the Green a Mixture of the intermediate Colours. I send you not this Account barely upon the Credit of my own Eyes; for there was a Clergyman and four other Gentlemen in Company, whom I desir'd to view the Colours attentively, who all agreed, that they appear'd in the manner that I have now describ'd.

There are two things, which well deserve to be taken notice of, as they may perhaps direct us in some measure to the Solution of this curious Phænomenon.

The 1<sup>st</sup> is,

That the Breadth of the first Series so far exceeded that of any of the rest, that as near as I could judge, it was equal to them all taken together.

The 2<sup>d</sup> is,

That I have never observ'd these inner Orders of Colours in the lower Parts of the Rainbow, tho' they have often been incomparably more vivid than the  
upper

upper Parts, under which the Colours have appear'd. I have taken notice of this so very often, that I can hardly look upon it to be accidental, and if it should prove true in general, it will bring the disquisition into a narrow compass; for it will shew that this Effect depends upon some Property, which the Drops retain, whilst they are in the upper part of the Air, but lose as they come lower, and are more mix'd with one another.

*Petworth, Oct. 13.*

1722.

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V. *A Letter to Dr. Jurin, Coll. Med. Lond. Soc. & Secr. R. S. concerning the abovementioned Appearance in the Rainbow, with some other Reflections on the same Subject. By Henry Pemberton, M. D. R. S. S.*

*S I R,*

UPON your communicating to me the curious Observations, your Friend Dr. *Langwith* had made on the Rainbow, I inform'd you those Appearances might, I thought, be explain'd by the Discoveries, the Great Sir *Isaac Newton* had made in the Subject of Light and Colours, in his wonderful Treatise of *Optics*. As you seem'd not displeas'd with what I mention'd to you in relation to this Matter by word of mouth, you desired that I would set down in writing my Thoughts thereupon, which I have here accordingly done in the following manner.

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